State of Illinois
Department of Registration and Education
STATE GEOLOGICAL SURVEY DIVISION
John C. Frye, Chief

GUIDE LEAFLET

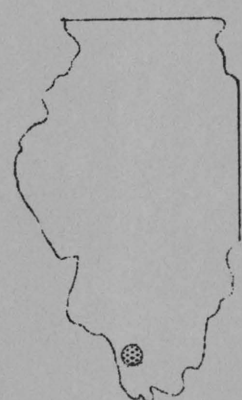
GEOLOGICAL SCIENCE FIELD TRIP

Sponsored by
ILLINOIS STATE GEOLOGICAL SURVEY

ALTO PASS AREA

Jackson and Union Counties

Altenburg, Jonesboro, and Alto Pass Quadrangles



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GUIDE LEAFLET 1965F

HOST: Alto Pass High School

ALTO PASS GEOLOGICAL SCIENCE FIELD TRIP

INTRODUCTION

The Alto Pass area is one of the most complexly faulted areas in Illinois. Two major faults, the Rattlesnake Ferry and the Pomona Faults (fig. 2), cross the area from southeast to northwest. These faults are the southeastern end of a major fault zone, called the Ste. Genevieve Fault System, which extends for 100 miles from Union County, Illinois, to Crawford County, Missouri.

The Rattlesnake Ferry Fault is a high angle reverse fault, which is upthrown on the southwest side. Stratigraphic displacement is about 2000 feet, and in the outcrop area the Lower Devonian Clear Creek Formation is thrust against the Lower Mississippian Ste. Genevieve Limestone. Southeastward the fault dies out into a monoclinal flexure in which the strata dip steeply northeastward. Initial movement along the Rattlesnake Ferry Fault took place during post-Mississippian - pre-Pennsylvanian time and recurrent movements took place during Pennsylvanian and post-Pennsylvanian time.

The Pomona Fault is north of and approximately parallel to the Rattlesnake Ferry Fault. The Pomona Fault is a normal fault, downthrown on the northeast side, with a stratigraphic displacement of about 200 feet. Together these faults bound a 4-mile belt of late Mississippian-early Pennsylvanian strata that are complexly faulted. These strata have a gentle regional dip of 1 to 2 degrees toward the northeast, but where faulted, they have much steeper dips.

The Rattlesnake Ferry Fault is not a single fault, but consists of a zone several hundred feet wide in which the rocks are disturbed. Nowhere is the fault plane actually exposed. Its approximate position can be seen on the Alto Pass Quadrangle map (refer to itinerary map) by the striking difference between the topography developed on the Mississippian and Pennsylvanian rocks northeast of the fault and that developed on the Devonian Clear Creek Formation on the southwest side. On the Devonian rocks a more closely-spaced stream pattern has developed.

Itinerary

0.0 0.0 Assemble in front of Alto Pass High School. Proceed east.

0.3 0.3 Bear sharply left and then right. Cross GM & O Railroad. STOP. Turn right. Continue up hill.

0.1 0.4 Prepare to stop.

0.1 0.5 Turn right into Cliff View Park. Stop 1. Battery Rock Sandstone. Discussion of Physiography of the Alto Pass area.

The sandstone exposed in the cliff face is the Battery Rock Sandstone Member of the Pennsylvanian Caseyville Formation. The Battery Rock consists of massive, cross-bedded, medium-grained, slightly micaceous, light brown sandstone. It is also slightly conglomeratic, containing well-rounded quartz pebbles, especially in the lower part. The sandstone is tightly cemented by silica and iron oxide, so that the Battery Rock is generally a cliff-former. In the Alto Pass area the Battery Rock is from 50 to

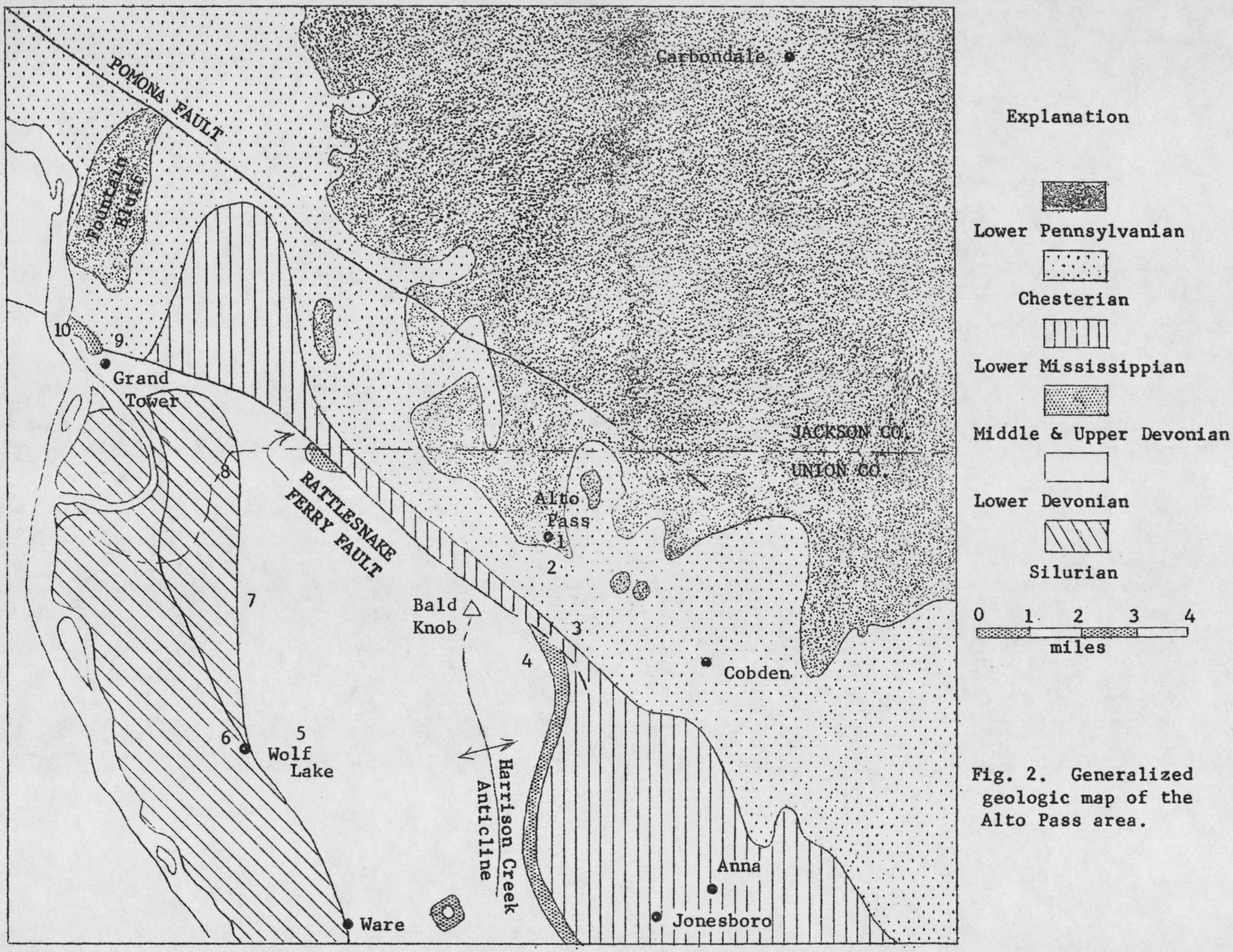


Fig. 2. Generalized geologic map of the Alto Pass area.

100 feet thick, and here about sixty feet is exposed. In the lower part of the cliff quartz pebbles are absent, and it is possible that the Battery Rock rests directly on the Degonia Sandstone of Mississippian age.

Outcrop surfaces of the Battery Rock are reddish because of the concentration of a thin layer of iron oxide. There are also bands and small concretionary structures, composed of iron oxide-cemented sandstone, which stand out in relief on outcrop surfaces. These features have formed by differential cementation by the iron oxide, which moved through the sandstone in solution and became concentrated in bands. This type of cementation by iron oxide is common in the Pennsylvanian sandstones.

The Battery Rock Sandstone is a nonmarine, alluvial sand that was deposited by rivers that shifted laterally over a low-lying Pennsylvanian landscape. The lower conglomeratic part is an early channel phase which was deposited with angular unconformity on the upper Chesterian formations. The environment was one of high energy and strong currents, which resulted in the deposition of fairly clean, cross-bedded sand. Some zones are more shaly and contain traces of plant remains. These may represent muddy sands that were deposited on flood plains.

Physiography

The Alto Pass region is located on the east flanks of the Ozark Dome. Structurally the highest part of the dome is in the St. Francois Mountains of Missouri, which lie less than 50 miles west of the Mississippi River. In these mountains, knobs of crystalline Precambrian rocks protrude through the overlying Paleozoic strata.

The most prominent features of the local structure are: (1) the Harrison Creek anticline, and (2) the Rattlesnake Ferry monocline and fault zone.

Bald Knob, which can be seen across the valley two miles to the southwest, is close to the northern end of the Harrison Creek anticline. Strata on the east side of the anticline have steeper dips, indicating an asymmetrical structure. Most evidence supports the idea that the anticline was formed before the beginning of the Pennsylvanian Period. The anticline also probably predates the first movement along the Rattlesnake Ferry Fault. The base of the bluff below Bald Knob marks the approximate fault line of the Rattlesnake Ferry Fault.

The Alto Pass region lies at the western end of a divide or ridge that extends from the confluence of the Saline and Ohio Rivers westward to the Big Muddy River near this locality. The topography of the different parts of the area is largely controlled by the attitude or position and the physical character of the underlying rocks. This region is located partly within the Salem Plateau section of the Ozark Plateau Province and partly within the Shawnee Hills Section of the Interior Low Plateaus Province.

The view to right and left of Bald Knob encompasses the southern part of the Salem Plateau Section, which forms the eastern edge of an extensive upland in southern Missouri and northern Arkansas. The Salem Plateau comprises the major part of the Ozark Dome in southern Missouri. That part of the plateau developed here is composed of maturely dissected, partially truncated cuestas that dip to the east and northeast. The whole of the area is mainly underlain by a thick succession of deeply weathered Mississippian and Devonian chert and cherty limestone formations.

This stop is near the boundary between the Salem Plateau Section and the Shawnee Hills Section. Portions of the latter can be seen toward the far left (southeast). The Salem Plateau is characterized by higher elevations, more rugged hills, and closely-spaced drainage lines. The Shawnee Hills includes a complexly dissected upland, that is underlain by Mississippian and Pennsylvanian strata. This is the area popularly called the "Illinois Ozarks."

Depositional History of the Pennsylvanian Sedimentary Rocks

The bedrock exposed in the Alto Pass area northeast of Rattlesnake Ferry Fault is of Pennsylvanian age. The Pennsylvanian rocks contain all of Illinois' minable coal beds, whose minable reserves are estimated to be 137 billion tons.

In addition to the coals, there are many different types of sedimentary rocks in the Pennsylvanian System. In Illinois, coals are commonly overlain by black sheety shale ("roof slate") followed by limestone with marine fossils. The limestone is usually overlain by gray shale also containing marine fossils. Beneath the coal there is an underclay, in turn sometimes underlain by limestone or shale, then sandstone.

The rhythmic succession of different kinds of strata is repeated in much the same sequence some 50 times where the Pennsylvanian rocks are thickest. Each rhythmic succession of Pennsylvanian rocks is called a cyclothem. An attached sheet shows an ideally complete cyclothem, but seldom do we find all the units present.

The thickness of the Pennsylvanian System and individual cyclothems varies greatly from place to place. An example of this is the interval between the Colchester (No. 2) Coal and the base of the Pennsylvanian. This interval averages about 125 feet in western Illinois, while in the southeastern part of the state this part of the Pennsylvanian column is represented by about 1200 feet of strata. Although deposition started relatively early in Pennsylvanian time in western Illinois, it either proceeded very slowly or was interrupted frequently by intervals when no sediments were deposited.

There is no area in the world today that has conditions exactly like those which existed during "Coal Measures" time. The many different rock types in the Pennsylvanian System indicate that rapid and repeated changes of environment took place. At that time, rivers were bringing sediments from the north and east, possibly from as far away as the present Atlantic coast and the region south of the Hudson Bay. The Midwest was a low-flat, swampy area lying just a little above sea level, but subject to frequent marine invasions as the land rose or sank or the sea level raised or lowered.

That these conditions existed is evident from the nature of the sediments. Many of the shales, limestones, and ironstones above the coals contain marine fossils. The coals are believed to have formed in broad fresh-water marshes somewhat like the present-day Dismal Swamp of Virginia. Most of the sandstones, conglomerates, underclays, underclay limestones, and some shales probably accumulated in fresh-water environments such as river valleys, lagoons, or lowland plains.

The plants and trees that grew in "Coal Measures" time were very luxuriant. In the jungle-like growths, the plants most common were huge tree ferns that had fronds five or six feet long and grew to a height of more than 50 feet. Along with them were seed ferns, now extinct; giant scouring rushes; and large trees, which grew to heights of 100 feet or more.

The large trees we find preserved in the coals do not have growth rings. The luxuriant growth and lack of growth rings probably indicate that the climate that prevailed at this time was warm and without seasonal change. As the plants fell into the swampy waters, they were partially preserved, buried by later sediments and converted into coal.

0.0 0.5 Leave Stop 1. Continue ahead southeast on Cobden Road.

1.3 1.8 On the right is another good view of the Salem Plateau toward the southwest.

0.1 1.9 SLOW. Prepare to turn around.

0.1 2.0 Make a U-turn and return to Alto Pass.

1.5 3.5 Entering Alto Pass.

0.2 3.7 Turn left. Cross railroad. Continue left and then sharply right.

0.4 4.1 Turn right and then bear left.

0.1 4.2 STOP. Intersection with Route 127. Turn left (south).

0.2 4.4 SLOW. Prepare to stop.

0.1 4.5 Stop 2. Fossil collecting in the Menard Limestone.

On the left are exposures of Menard Limestone and Palestine Sandstone of the Mississippian Chesterian Series. In the Alto Pass area these units are about 90 feet and 30 feet thick, respectively.

The Menard exposed here consists of massive, dark gray, fossiliferous, oolitic calcarenite. There are a few gray-green shale beds, which thicken slightly toward the northwest. The upper few feet consist of gray-green shale beds and thin-bedded biocalcarenites. Some of the latter are composed almost entirely of fossils and fossil fragments. Collecting is very good, and most of the fossils illustrated in the plate at the back of the guide leaflet can be found.

The Menard grades upward into shaly sandstone of the lower part of the Palestine, and there is apparently no erosional break between the two formations. North of the ravine on the left, more of the Palestine is exposed above the lower shaly zone. It consists of very pure, limonite-speckled orthoquartzite. The sandstone is cross-bedded and bedding planes are ripple-marked.

The Chesterian formations of southern Illinois are characterized by striking lateral and vertical changes in lithology. These changes reflect the great variability in the environments of deposition on the floor of the shallow Late Mississippian sea. In the Alto Pass area the Chesterian formations are thin, usually only a few tens of feet thick, but they thicken toward the east and southeast. The Alto Pass area, under the influence of the Ozark Dome, did not subside as much as areas farther east in the Illinois Basin, so that less sediment accumulated.

During deposition of most of the Menard Limestone, conditions on the Mississippian sea floor remained fairly constant. Broken fossils and oolites in the massive limestone indicate shallow water, but essentially pure lime sediment with little terrigenous sand and mud was deposited. Shale in the upper part of the Menard indicates that the sea became muddy. Still later, the sea cleared again or became much shallower, and there was an influx of sand to account for the clean quartz sandstone of the Palestine Formation.

Depositional History of the Mississippian Sedimentary Rocks

The Mississippian sedimentary rocks in the Mississippi Valley are predominantly marine limestones, and many of them are richly fossiliferous. They have a thickness of between 2000 and 2500 feet and comprise the type section for which the Mississippian System was named.

In the Alto Pass area the Mississippian formations are exposed along the southwestern margin of the Illinois Basin (fig. 1), a sub-circular structural depression 250 to 300 miles in diameter covering most of Illinois, southwestern Indiana, and western Kentucky. The lower Mississippian formations (Kinderhookian) are largely shale, limestone, siltstone, and sandstone; the middle Mississipian (Valmeyeran) formations are dominantly limestone; but the upper Mississippian (Chesterian) formations consist of limestones, sandstones, and shales, with the sandstones and shales dominant.

During Mississippian time, the Midcontinent of North America was a generally low-lying, stable platform. Clear, warm, shallow seas invaded the region, and the Mississippi Valley remained almost continually submerged throughout the Mississippian Period. During the middle part of the period the seas reached far to the north, and relatively pure limestones were deposited over enormous areas on the continental platform. During the later part of the period the seas became more restricted, and much sandstone and shale was deposited.

Throughout Mississippian time the Illinois Basin was a slow subsiding region, flanked on the east and west by structurally high, or positive, areas - the Ozark Dome and the Cincinnati Arch. These higher areas supplied little sand and mud to the Illinois Basin, and most clastic sediments were carried into the basin from land areas far to the northeast in Canada by an ancient river system called the Michigan River (fig. 1). The Michigan River built deltas into the sea, much like the present-day Mississippi River delta in Louisiana. During Chesterian time an extensive delta front oscillated northward and southward for hundreds of miles as the basin subsided.

The fluctuating shorelines, shifting delta distributaries, and the continually changing water depths produced the striking vertical and lateral lithological variations that can now be seen in the Chesterian formations. Regular alternation of sandstone-shale and limestone formations were formed, each alternation beginning with deposition of basal sandstone and shale followed by deposition of limestone. In some respects the sediments in the Chesterian Series resemble the cyclothems of the Pennsylvanian System, which overlies the Mississippian rocks in much of Illinois.

Some of the Chesterian limestones, such as the Menard, are very pure, but some are quite argillaceous and sandy. Generally, the Chesterian sea was shallow, probably no more than 100 feet deep. Oolitic zones are common in the limestones, as are zones consisting of a hash of fossil remains that were

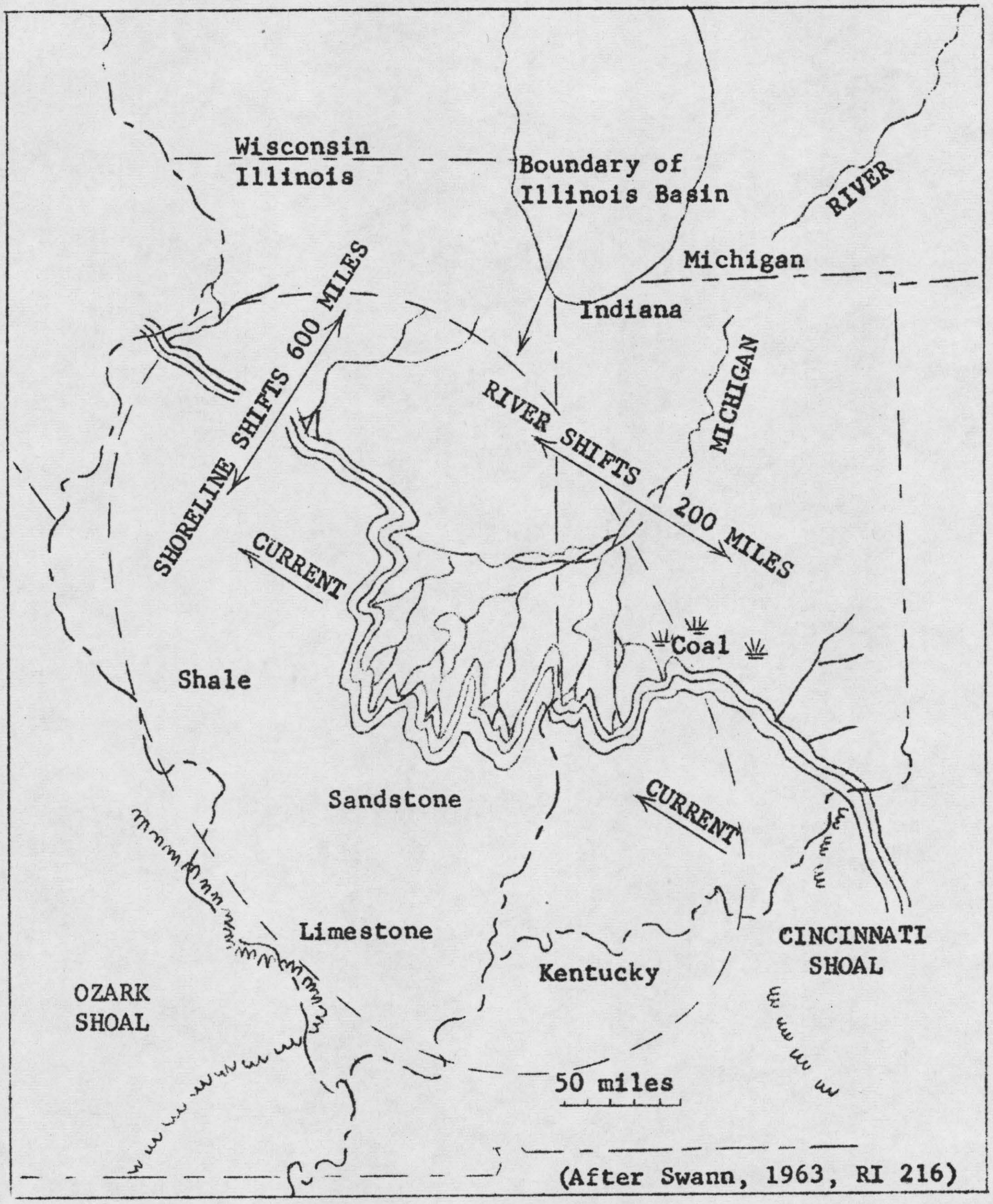


Fig. 1. The Michigan River delta during Chesterian time.

broken by wave action. Sedimentary features such as pebbly zones, ripple marks, and cross-bedding are present in the sandstones, many of which are channel sands. Thin coal seams associated with some of the sandstones indicate times when the sea withdrew and plant debris accumulated in fresh-water swamps.

0.0 4.5 Leave Stop 2. Continue southeast on Route 127.

1.9 6.4 Prepare to stop.

0.1 6.5 Stop 3. Discussion of sedimentary structures in Mississippian sandstone.

The sandstone exposed here belongs to the Ste. Genevieve Limestone of the Mississippian Valmeyeran Series. The Ste. Genevieve is normally gray, oolitic limestone. This sandy phase may indicate a temporary shoaling of the Ste. Genevieve sea or a sudden influx of sand into the area.

The sandstone is very light gray and medium-grained in texture. It looks almost exactly like the Palestine Sandstone at Stop 2. It weathers reddish brown on outcrop surfaces and along bedding planes. Some zones are greenish, and along some bedding planes there are thin, discontinuous lenses of soft, waxy, green shale. Where these have weathered out, the sandstone is pocked with small, lenticular cavities.

The sandstone exhibits a variety of sedimentary structures, including cross-bedding, ripple marks, drag marks, and flute casts. These features form in a shallow water, high energy environment. The flutings are scour features and indicate that, at times during deposition of the sand, the bottom currents were very strong. The drag marks were made by something, perhaps tree branches, which were swept along by the currents.

Load casts, which are the result of compaction following deposition, are also present in the sandstone. On some of the bedding planes there are ramifying networks of sandstone-filled cracks. These resemble mud cracks, but Dr. W. A. White of the Survey recently described them as syneresis cracks. Syneresis cracks form after deposition and burial due to the loss of water from sediments, which causes shrinkage. The sandstone fillings were then squeezed in from above or below.

The dip of the sandstone beds here is about 15 degrees, which is much greater than the dips of the strata at Stops 1 and 2. The steeper dip may be the result of slumping due to solution of underlying limestone, because just over the ridge toward the southwest, there are large sinkholes in the lower part of the Ste. Genevieve (see itinerary map). However, this stop is only about half a mile from the Rattlesnake Ferry Fault on the upthrown block, so that the increased dip may be the result of friction that dragged or bent the beds upward during faulting.

0.0 6.5 Leave Stop 3. Continue south on Route 127.

0.4 6.9 On the right are sinkholes in Mississippian limestone.

0.1 7.0 On the left another sinkhole.

0.9 7.9 On the right is a reddish cherty gravel with both rounded and angular Devonian chert fragments, including boulders. The deposit is colluvium, derived from the Devonian formations which form the hill above it.

0.0 7.9 SLOW. Prepare to turn right.

0.1 8.0 Crossroads. Turn right (west) on gravel road.

0.5 8.5 Continue northwest along the valley flat of Clear Creek.

0.2 8.7 Exposure of Wisconsinan loess on the right.

0.1 8.8 Straight ahead is Bald Knob.

0.2 9.0 Bear left. SLOW. Prepare to stop.

0.1 9.1 Stop 4. Exposure of Devonian Grand Tower Limestone, Dutch Creek Sandstone, and Clear Creek Chert.

This stop is on the southwest (upthrown) side of the Rattlesnake Ferry Fault in the outcrop belt of the Devonian rocks.

The thickest outcropping section of Devonian strata in Illinois, totaling some 1500 feet, occurs in the Alto Pass area in southern Jackson, western Union, and northern Alexander Counties. Where not overlain by younger rocks, the Devonian formations are deeply weathered and altered by silicification. Most of the exposed formations consist of a monotonous succession of silicified limestone and novaculitic chert.

The Devonian strata contain an unusual abundance of chert, whose origin is not definitely known. There is no question that the Devonian rocks have been "chertified," and that most of the chert is secondary, but where the silica came from is open to question. Some chert was deposited with the Devonian limestones. However, secondary chert has replaced limestone, and sedimentary structures, fossils, and styolites are preserved. Over a very long period of time the limestone was gradually replaced by silica that may have been weathered and leached from younger rocks.

The exposure here includes the lower part of the Grand Tower Limestone, the Dutch Creek Sandstone Member of the Grand Tower, and the upper part of the Clear Creek Chert. A more complete section of the Grand Tower will be seen at Stop 10. Of particular interest here is the unconformity between the Grand Tower and the Clear Creek Formations. The unconformity is evidence that an interval of erosion occurred after deposition of the Clear Creek. When the Middle Devonian sea readvanced across the area (about 350 million years ago), the calcareous quartz sand of the Dutch Creek Member was deposited on this erosion surface. The section is shown on page 8.

As the sea deepened and the shore migrated farther away, a gradual change to the deposition of the purer limestone of the Grand Tower took place.

The Clear Creek here consists of an alternation of thin, sandy limestones, and beds of gray, calcareous chert. In some places in southern Illinois the calcareous material has been leached from the chert, producing pure, fine-grained, powdery, white silica, called tripoli. Tripoli is presently being mined in Alexander County, and most of the tripoli is used in the manufacture of abrasives and buffing compounds.

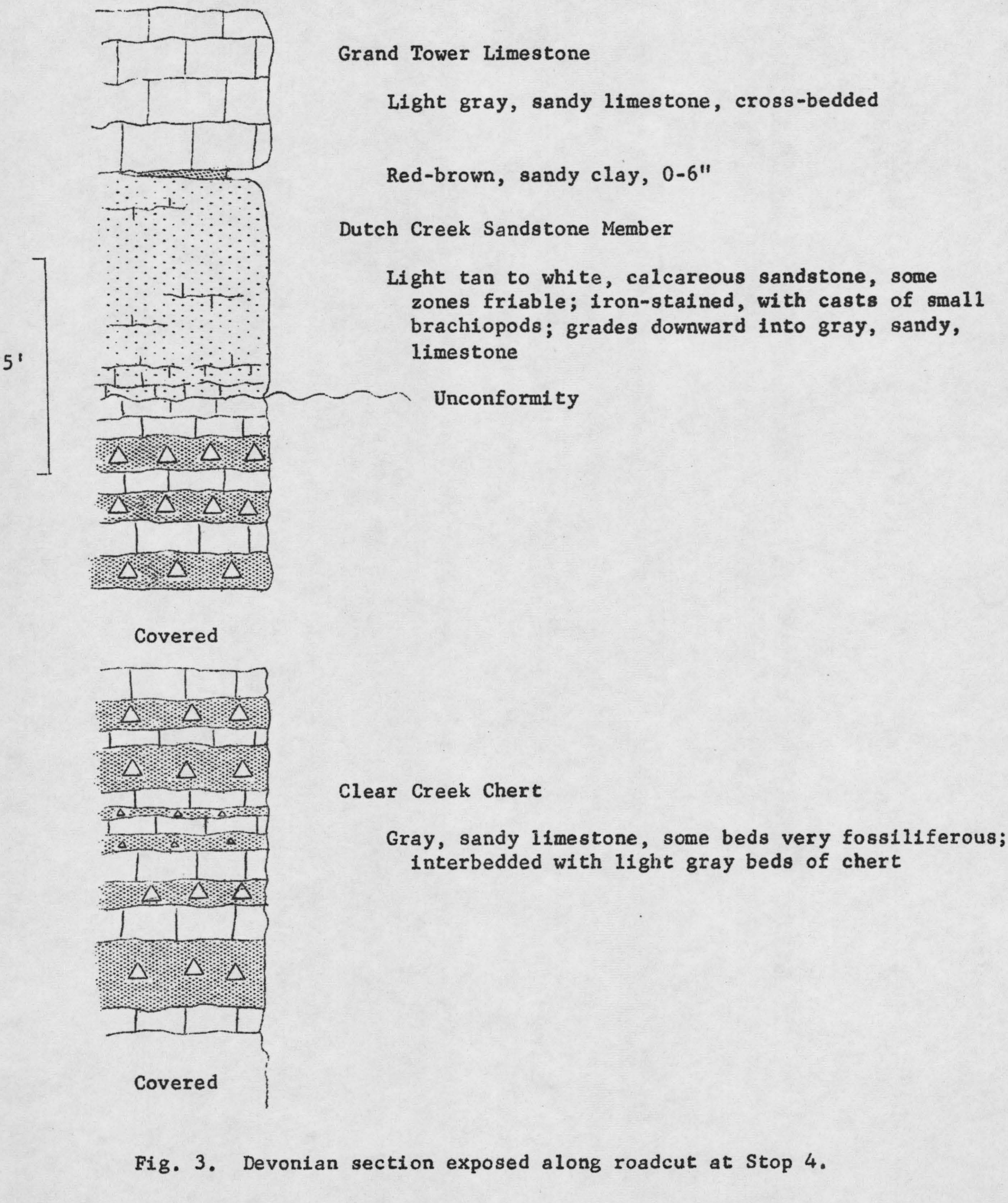


Fig. 3. Devonian section exposed along roadcut at Stop 4.

0.0	9.1	Leave Stop 4. Continue ahead (northwest).
0.1	9.2	Ahead in the foreground the flood plain at the junction of Seminary Fork and Clear Creek broadens out.
0.5	9.7	SLOW. Bridge over Clear Creek, 5-ton limit. Turn left at Y-intersection. Continue southwest.
0.1	9.8	Small bridge. SLOW.
0.6	10.4	SLOW. Sharp right turn.
0.6	11.0	Straight ahead is an excellent view of the cross profile of Clear Creek Valley. Resistant Clear Creek Chert forms the steep valley walls.
1.0	12.0	Cross-bed of dry stream. The bed of the stream is covered with angular chert fragments derived from the Clear Creek Chert.
0.4	12.4	Cross bridge.
0.4	12.8	Cross bridge.
0.1	12.9	Cross small bridge over dry creek.
0.6	13.5	SLOW. Prepare to turn left.
0.1	13.6	T-road intersection. Turn left (south).
0.1	13.7	Bridge over Hutchins Creek. Load limit 5 tons. The bed load of this creek is also angular chert. On the right is a bluff of Devonian chert.
0.5	14.2	SLOW. Curve sharply right.
0.2	14.4	SLOW. Curve sharply left.
0.2	14.6	Small bridge.
0.5	15.1	Small bridge.
0.3	15.4	STOP. Turn right (northwest).
0.2	15.5	On the left is the broad, flat expanse of the Mississippi River flood plain.
2.4	17.9	SLOW. Prepare to stop.
0.1	18.0	<u>Stop 5</u>. Exposure of Pleistocene loess and travertine.

On the right is a recent cut in cherty gravel and Wisconsinan loess. The cherty gravel is a colluvial deposit composed of weathered residuum from the cherty Devonian rocks, which form the bluff. Above the gravel is about 35 feet of loess, which was blown from the Mississippi River flood plain during the Pleistocene Epoch.

Nearly all of Illinois is covered by thin surficial deposits of glacial loess which consist principally of silt with subordinate amounts of sand or clay. The loess deposits exposed here were deposited during the times of advance and retreat of the Wisconsinan glacier in Illinois from 60,000 to 10,000 years ago. The Wisconsinan glacier never reached the Alto Pass area, but meltwaters from the glacier deposited large volumes of silt in the bottom lands of Mississippi Valley, and these were the source for the loess.

Most of the loess deposition probably occurred during the fall and early winter when winds from the northwest were strong and when the meltwaters from the glaciers had subsided, exposing the floodplain sediments and permitting them to dry.

The loess is thicker on the east bluffs of the river than on the west, and toward the east the loess becomes progressively thinner and finer grained.

Of particular interest in this exposure is a thin travertine deposit, which occurs about in the middle of the loess section and roughly parallels the top of the hill. The travertine consists of brownish gray, porous calcium carbonate and is a prominent, dark band across the face of the cut. The travertine was probably precipitated from lime-rich ground water, which may have percolated through the loess and emerged along a zone of high permeability. However, the loess above and below the travertine is calcareous and contains limestone concretions and fossil snails. Therefore, the travertine may have been precipitated on the surface during a temporary interruption of loess deposition, and then later was covered by more loess.

0.0	18.0	Leave Stop 5. Continue west.
0.2	18.2	T-road from right at sign saying "Pine Hills Scenic Drive." Continue straight ahead (west).
0.5	18.7	Cross railroad crossing. CAUTION. Three tracks and siding. STOP. Intersection with Route 3. Turn right (northwest).
0.2	18.9	Entering Wolf Lake.
0.2	19.1	Turn left at sign saying "Wilson Insurance Agency." Continue straight ahead through cross-street intersection.
0.1	19.2	Turn left. Continue ahead in front of school. Stop 6. Lunch.
0.0	19.2	Leave lunch stop. Return to Highway 3.
0.1	19.3	STOP. Intersection with Highway 3. Turn right (southeast).
0.3	19.6	Turn left. Cross railroad siding and railroad crossing. CAUTION. Three tracks.
0.5	20.1	SLOW. Prepare to turn left.
0.1	20.2	Turn left at sign saying "Pine Hills Scenic Drive." Continue ahead north. Enter Shawnee National Forest. CAUTION. Devonian chert has been used to surface the road through the park. Drive slowly and do not drive on the shoulders where the chert has piled up.

0.7 20.9 Shawnee National Forest Campground. Continue straight ahead past the campground.

0.7 21.6 SLOW. Cross culvert over dry creek. Dip in road.

0.8 22.4 Culvert. Dip in road.

1.2 23.6 Curve left.

0.4 24.0 SLOW. Prepare to stop.

0.1 24.1 Stop 7. Discussion of the Mississippi River Valley.

Toward the west is a view of the Mississippi River and its valley from near the crest of the Pine Hills escarpment. This ridge is capped by the Grassy Knob Chert Member of the Bailey Limestone Formation of Lower Devonian age. The Grassy Knob ranges in thickness from 10 to 50 feet and is composed of reddish chert that has an irregular, brecciated structure broken by many joints. The rock here forms the cliff below which the steep slopes are lightly covered by loess-derived silt and partly by loose chert talus. Narrow stream channels which are developed in this zone have bottoms that broaden slightly before forming cascades or waterfalls over the underlying Bailey Limestone Formation. The impressive cliffs in this area are developed in the Bailey Formation.

The walls of the Mississippi Valley, which rise 350 to 400 feet above the flood plain, owe their steepness to the resistant nature of the Devonian cherty limestone to erosion. The valley flat is slightly more than four miles wide at this point. Although at present the Mississippi flows against the Missouri side of the valley, it has not always done so. Swampy areas along abandoned channels and meander scars of the river can be seen.

0.0 24.1 Leave Stop 7. Continue ahead north.

0.3 24.4 SLOW. Very winding road.

1.1 25.5 Y-intersection. Bear left.

0.4 25.9 On the left is an excellent view of the Mississippi River flood plain, the meandering Big Muddy River and meander scars and ox-bow lakes of the Big Muddy and Mississippi Rivers.

0.5 26.4 T-intersection. Turn right.

0.3 26.7 Spring Grove Ridge Picnic Area on the left. Another magnificant view of the Mississippi Valley. Each of the many picnic areas along this road affords scenic views of the valley.

1.7 28.4 McCann Spring Picnic Ground.

0.1 28.5 T-intersection. Turn left. Sign pointing to State Highway 3. On the left is an excellent exposure of the Devonian Bailey Limestone.

0.2 28.7 Note the large blocks of Bailey Limestone.

0.1 28.8 Stop 8. Exposure of Devonian Bailey Limestone.

The Bailey Limestone forms the sheer 100-foot cliff on the right. The Bailey, which is about 300 feet thick in this area, is the oldest unit of the Devonian System in southwestern Illinois. The formation consists of thin-bedded, slightly shaly, cherty, gray limestone. At the top of the bluff it is overlain by Grassy Knob Chert.

0.0 28.8 Leave Stop 8.

0.1 28.9 T-intersection from right. Turn right (west). The road is along the top of a man-made levee.

0.4 29.3 Back toward the east is a view of the Bailey Limestone bluff.

0.2 29.5 SLOW. Curve to the left.

0.9 30.4 Railroad crossing. CAUTION. One track.

1.4 31.8 Railroad crossing. CAUTION. One track. Cross railroad and STOP. Intersection with Route 3. Turn right (north).

0.1 31.9 Cross Big Muddy River. Continue ahead towards Grand Tower.

1.6 33.5 On the right note the steep bluff of Bailey Limestone toward Stop 8.

2.9 36.4 Straight ahead is Fountain Bluff.

Fountain Bluff is composed mainly of Pennsylvanian Caseyville Sandstone. Mississippian rocks outcrop below the Caseyville along the southwestern edge. This large bedrock hill is bounded on the north by the Pomona Fault and on the south by the Rattlesnake Ferry Fault.

0.3 36.7 SLOW. Prepare to turn left.

0.1 36.8 T-road from left. Turn left toward Grand Tower.

0.3 37.1 Toward the northwest on the right is Walker Hill, which is composed mainly of the Mississippian Salem and St. Louis Limestones.

0.5 37.6 Enter Grand Tower.

0.1 37.7 T-intersection from right. Turn right before railroad crossing. Continue straight ahead (northwest).

0.5 38.2 Crossroads. Turn right and go up hill.

0.4 38.6 Enter Walker Hill Cemetery. Stop 9. Discussion of erosional features of the Mississippi Valley.

The view toward the northeast and east is across the abandoned segment of Mississippi Valley toward Fountain Bluff and the east valley wall. The Rattlesnake Ferry Fault crosses the valley beneath the alluvial fill between here and Fountain Bluff. The cliff along the south end of Fountain Bluff is composed largely of Pennsylvanian Battery Rock Sandstone. The Battery Rock is underlain by the Mississippian Palestine Sandstone and Menard Limestone and is overlain by the Pennsylvanian Pounds Sandstone.

Walker Hill, the Backbone, and Fountain Bluff are erosional bedrock features, that were once part of the western bluff of the Ancient Mississippi River. They became isolated on the Mississippi valley flat when the river shifted from the valley east of Fountain Bluff to its present position. The cause of this shifting is probably related to the Pleistocene glaciation of the region.

The Pleistocene Illinoian glaciation occurred 250 to 200 thousand years ago, and Illinoian glacial till occurs about 8 miles to the northeast along Cedar Creek in Jackson County. It is possible that the glacier moved into the Alto Pass area and crossed the Mississippi Valley to the bluff on the Missouri side. The ice dammed the river and caused it to flow across the upland along the edge of the west bluff, where it intercepted a tributary valley and cut a new channel. When the ice melted away, the river had permanently established its present channel on the west side of Fountain Bluff.

No direct evidence exists to confirm that the ice actually advanced this far, but considering the high relief of the area, any drift deposited by the ice could easily have been removed by erosion.

During the Wisconsinan glaciation and Recent time the river alluviated its valley. There is a maximum of about 200 feet of glacial outwash and Recent alluvium in the abandoned Mississippi River bedrock valley. When the Wisconsinan glacier melted, an enormous amount of water flowed downvalley, and the old channel was again temporarily used by the river.

0.0 38.6 Leave Stop 9.

0.1 38.7 Turn left. Drive slowly through center of the cemetery. Turn left again. Return to cemetery entrance. Turn right and leave cemetery.

0.2 38.9 Continue ahead south.

0.2 39.1 Descend steep hill. SLOW. Prepare to turn right.

0.1 39.2 Crossroads. Turn right.

0.4 39.6 Continue ahead northwest.

0.2 39.8 On the right is an abandoned quarry in Mississippian Salem Limestone, which dips steeply northeast toward the Rattlesnake Ferry Fault. About 50 yards farther east the St. Louis Limestone is exposed.

0.0 39.8 Intersection of 3rd Avenue and 20th Street. Turn left on 20th Street.

0.1 39.9 Intersection of 20th Street and 4th Avenue. Continue ahead on 20th Street (west).

0.2 40.1 Intersection 20th Street and 5th Avenue. Continue ahead on 20th Street. Cross railroad track and immediately turn left (south) on road to Devil's Backbone Park.

0.2 40.3 Y-intersection from left. Continue straight ahead. Enter Devil's Backbone Park. Bear right.

0.1 40.4 Stop 10. Exposure of Devonian Lingle and Grand Tower Formations in the Backbone.

The park is adjacent to a narrow ridge called the "Devil's Backbone." The ridge is a hogback held up by resistant Devonian limestones and cherts that have a steep northeasterly dip toward the Rattlesnake Ferry Fault. These rocks have been quarried at numerous localities in this vicinity. As pointed out earlier, this ridge, along with Walker Hill to the east and Fountain Bluff to the north, was once part of the west bluff of the Mississippi River.

The Rattlesnake Ferry Fault, whose exact position is concealed by the alluvial valley fill, is located to the northeast of the Devil's Backbone and Walker Hill. These two hills are on the upthrown side of the fault, whereas Fountain Bluff, less than a mile to the north, is on the downthrown side.

The vertical displacement along the fault in this area is several hundred feet. A parallel fault crosses the Backbone and Walker Hill near their southern ends, and a cross fault running north-south occurs between the two hills.

The geologic section exposed at the north end of the park behind the pavillion is as follows:

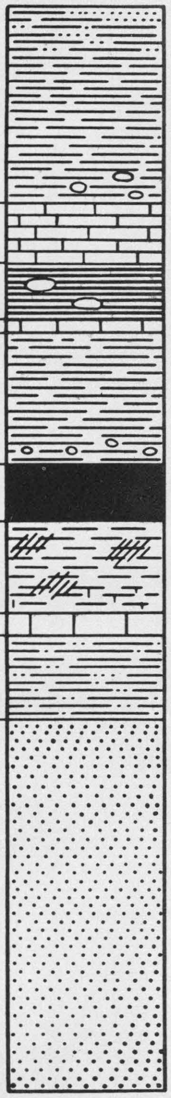
	Thickness
Lingle Limestone Formation	
Shale, greenish gray, fossiliferous	10'
Limestone, buff to tan, finely crystalline, fossiliferous	20'
Grand Tower Limestone Formation	
Limestone, gray, finely crystalline, cross-bedded in lower part, some fossiliferous zones	85'

The Grand Tower Limestone was named after the city of Grand Tower. Another excellent exposure of this formation occurs farther northwest in the Devil's Bake Oven. The entire thickness (157 feet) of the formation, including the Dutch Creek Sandstone Member, is exposed when the river is low, and is the type section.

Toward the southwest near the Missouri side, the small rock island known as Grand Tower rises above the Mississippi River. The island is composed of Bailey Limestone, which also forms the west bluff of the river. Measuring only one-fourth acre, Grand Tower is the smallest National Park in the United States and was set aside in 1871 by President Grant.

End of trip

Drive carefully on your way home.



10 Shale, gray, sandy at top; contains marine fossils and ironstone concretions especially in lower part.

9 Limestone; contains marine fossils.

8 Shale, black, hard, laminated; contains large spheroidal concretions ("Niggerheads") and marine fossils.

7 Limestone; contains marine fossils.

6 Shale, gray; pyritic nodules and ironstone concretions common at base; plant fossils locally common at base; marine fossils rare.

5 Coal; locally contains clay or shale partings.

4 Underclay, mostly medium to light gray except dark gray at top; upper part noncalcareous, lower part calcareous.

3 Limestone, argillaceous; occurs in nodules or discontinuous beds; usually nonfossiliferous.

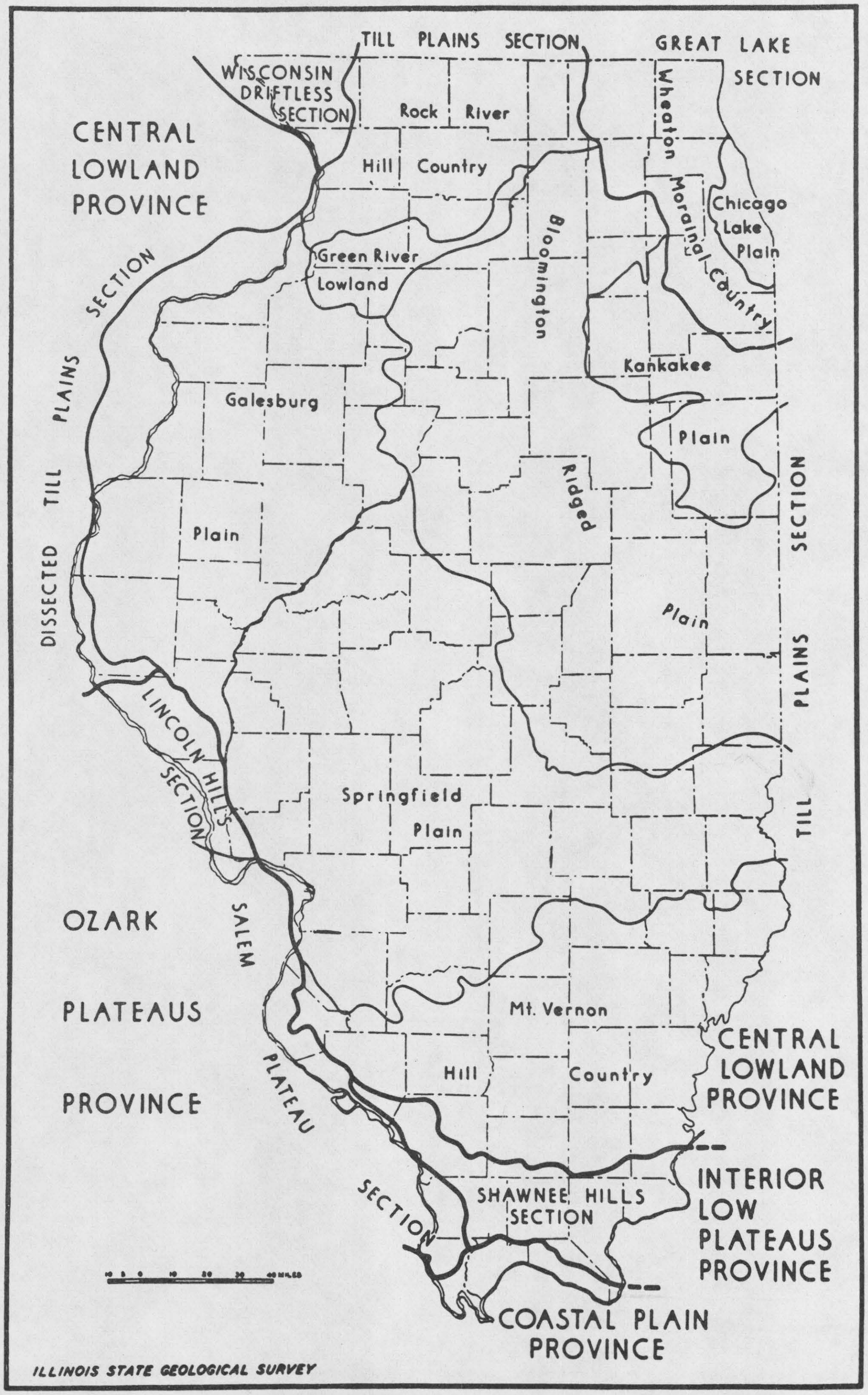
2 Shale, gray, sandy.

1 Sandstone, fine-grained, micaceous, and siltstone, argillaceous; variable from massive to thin-bedded; usually with an uneven lower surface.

AN IDEALLY COMPLETE CYCLOTHEM

(Reprinted from Fig. 42, Bulletin No. 66, Geology and Mineral Resources of the Marseilles, Ottawa, and Streator Quadrangles, by H. B. Willman and J. Norman Payne)

(47669—15M—11-61)

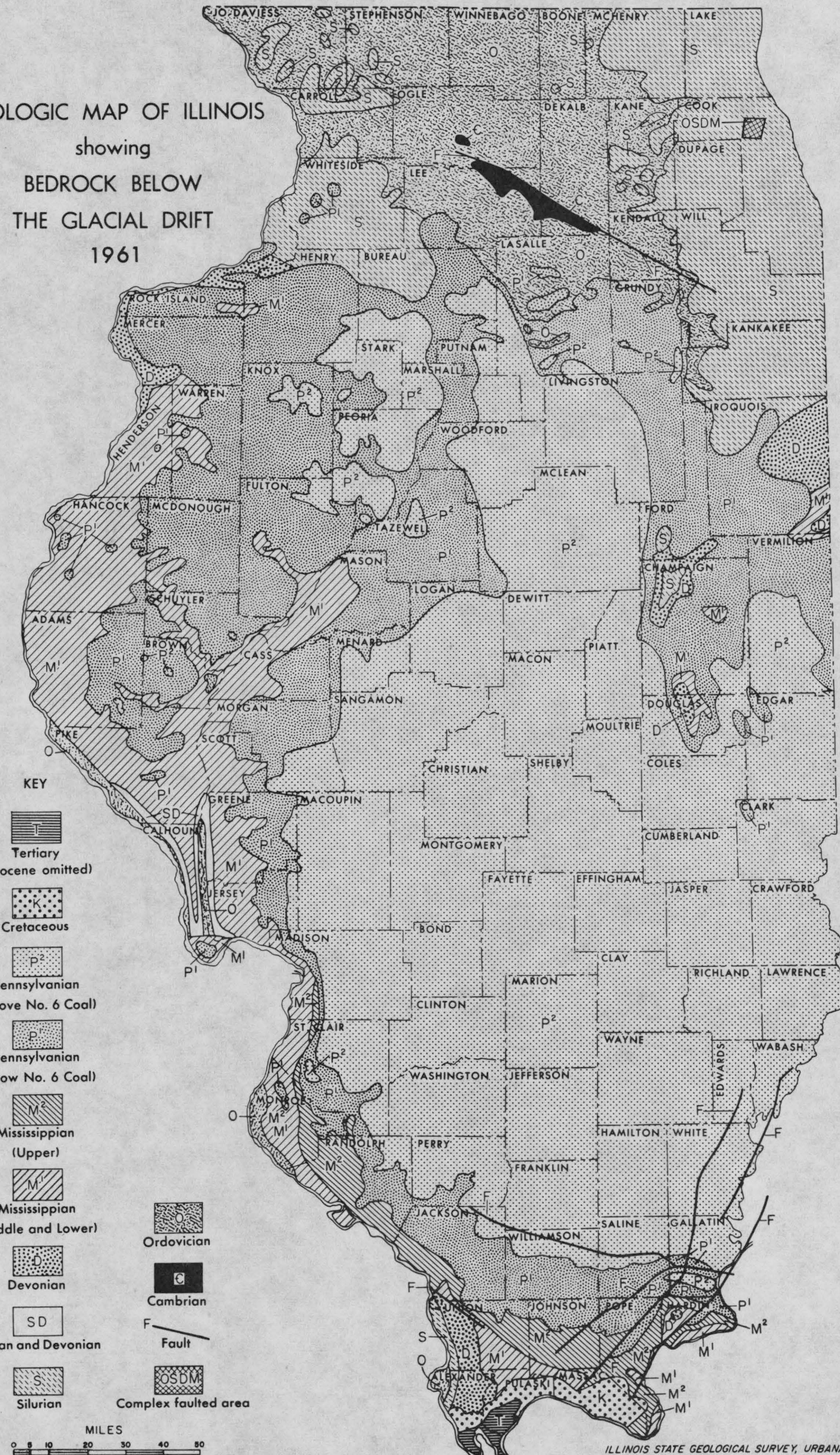


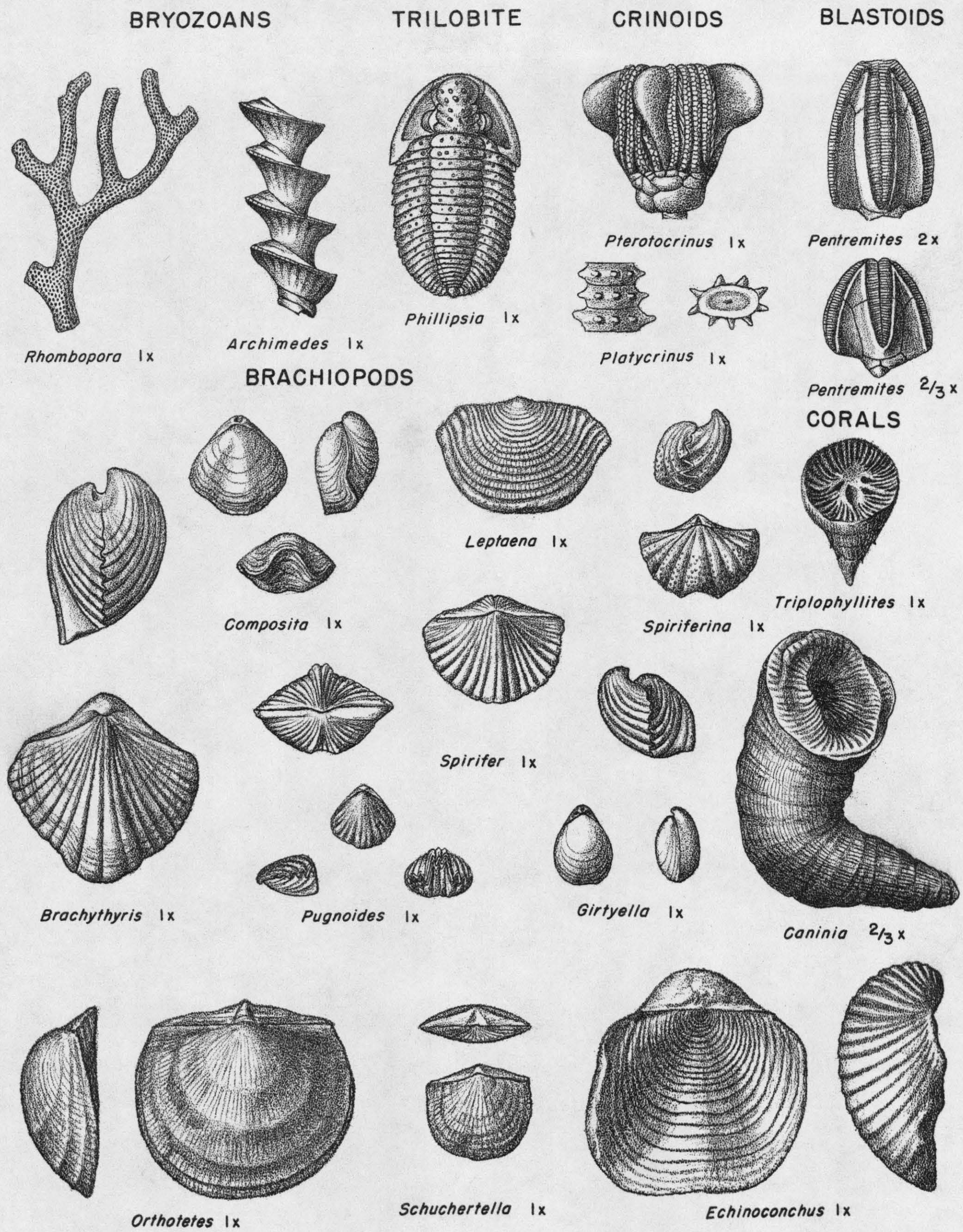
PHYSIOGRAPHIC DIVISIONS OF ILLINOIS

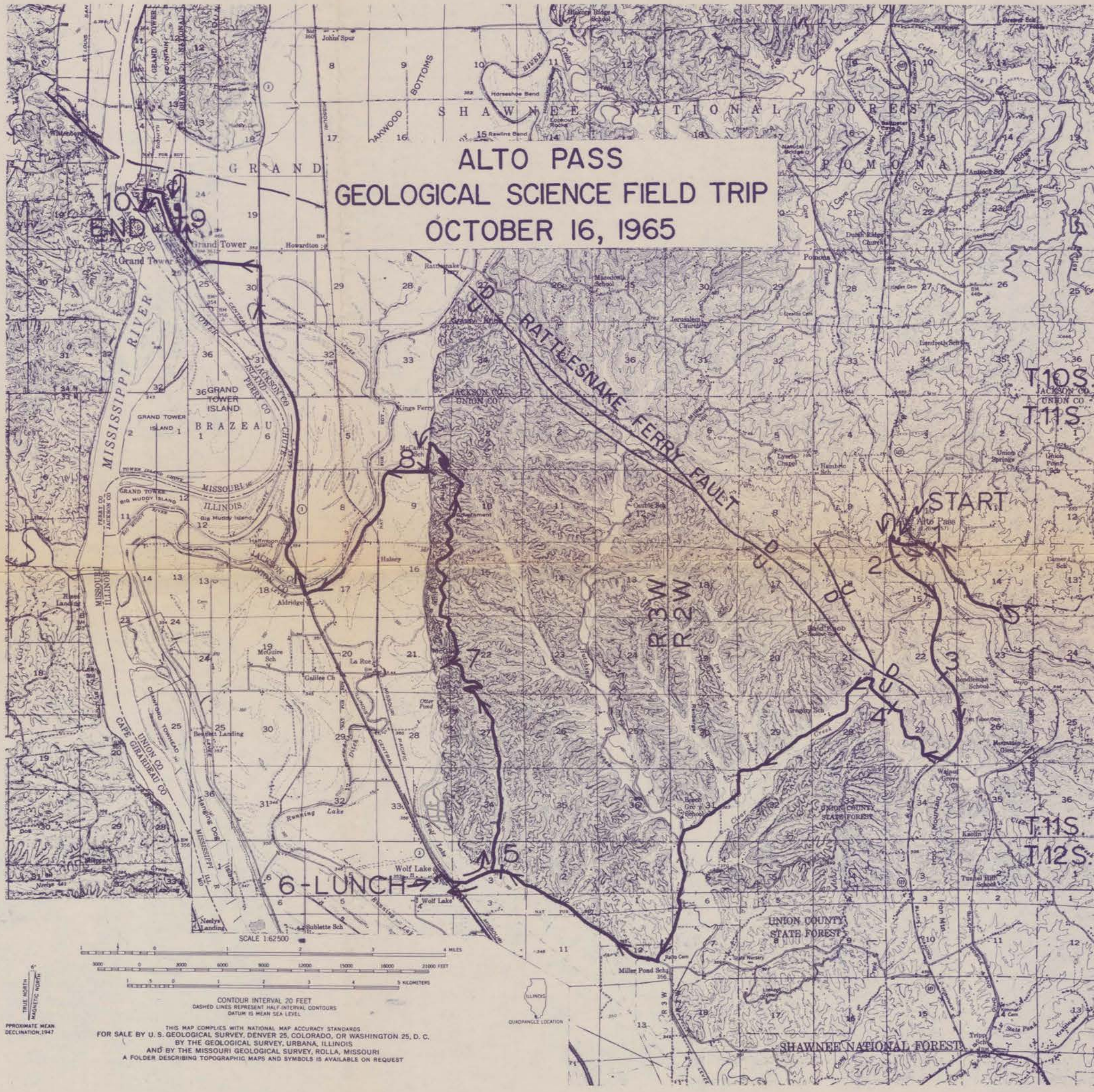
(Reprinted from Illinois State Geological Survey Report of Investigations 129, "Physiographic Divisions of Illinois," by M. M. Leighton, George E. Ekblaw, and Leland Horberg)

(47669—15M—11-61)

GEOLOGIC MAP OF ILLINOIS
showing
BEDROCK BELOW
THE GLACIAL DRIFT
1961




BRYOZOANS
TRILOBITE
CRINOIDS
BLASTOIDS
Rhombopora 1x
Archimedes 1x
Phillipsia 1x
Pterotocrinus 1x
Platycrinus 1x
Pentremites 2x
Pentremites 2/3 x
BRACHIOPODS
CORALS
Composita 1x
Leptaena 1x
Spiriferina 1x
Triplophyllites 1x
Spirifer 1x
Brachythyris 1x
Pugnoides 1x
Girtyella 1x
Caninia 2/3 x
Orthotetes 1x
Schuchertella 1x
Echinoconchus 1x


ALTO PASS
GEOLOGICAL SCIENCE FIELD TRIP
OCTOBER 16, 1965
START
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END
RATTLESNAKE FERRY FAULT
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D
T.10S.
T.11S.
T.11S.
T.12S.
R3W
R2W
MISSISSIPPI RIVER
SHAWNEE NATIONAL FOREST
GRAND TOWER ISLAND
BRAZEAU
POMONA
UNION COUNTY STATE FOREST
SCALE 1:62500
CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT HALF-INTERVAL CONTOURS
DATUM IS MEAN SEA LEVEL
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
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